APPENDIX 10D

Electrical Engineering Design Criteria

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10D.1 Introduction

This appendix summarizes the codes, standards, criteria, and practices that will be generally used in the design and construction of electrical engineering systems for the Walnut Energy Center (WEC). More specific project information will be developed during execution of the project to support detailed design, engineering, material procurement, and construction specifications.

10D.2 Codes and Standards

The design of the electrical systems and components will be in accordance with the laws and regulations of the federal government, State of California, City of Turlock ordinances, and industry standards. The current issue or revision of the documents at the time of the filing of this Application for Certification (AFC) will apply, unless otherwise noted. If there are conflicts between the cited documents, the more conservative requirement shall apply.

The following codes and standards are applicable to the electrical aspects of the power facility.

- American National Standards Institute (ANSI)
- American Society for Testing and Materials (ASTM)
- Anti-Friction Bearing Manufacturers Association (AFBMA)
- California Electrical Code 1998
- Insulated Cable Engineers Association (ICEA)
- Institute of Electrical and Electronics Engineers (IEEE)
- Illuminating Engineering Society (IES)
- National Electrical Code (NEC)
- National Electrical Manufacturers Association (NEMA)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA)
- Underwriters Laboratories, Inc. (UL)

10D.3 Switchyard and Transformers

10D.3.1 Switchyards

Separate 69-kV and 115-kV switchyards will be included at the WEC site. One combustion turbine generator unit will connect to each of the two switchyards via a generator step-up transformer, and the steam turbine generator will be connected to both switchyards via its generator step-up transformer.

The switchyards will consist of SF6 circuit breakers for the transformers and lines to the grid, with disconnect switches on each side of the breakers. Each line will be equipped with the appropriate instrument transformers for protection and metering. Instrument transformers will also be used for generator synchronizing. Surge arresters will be provided for the outgoing lines in the area of the takeoff towers.

The switchyards will be located near the main step-up transformers and will require an overhead span for the connection.

The SF6 breakers will be of the dead tank design with current transformers on each bushing. Disconnect switches will be located on each side of the breakers to isolate the breaker, and one switch will be located at each line termination or transformer connection for isolation of the lines or transformer for maintenance. Tubular bus used on the bus will be aluminum alloy. Cable connections between the tube bus and equipment will be ACSR, AAAC, or AAC cable. Tube and cables will meet all electrical and mechanical design requirements. Instrument transformers (current and capacitive voltage transformers) will be included for protection and synchronization. The switchyard design will meet the requirements of the National Electrical Safety Code--ANSI C2.

A grounding grid will be provided to control step and touch potentials in accordance with IEEE Standard 80, Safety in Substation Grounding. All metallic equipment, structures and fencing will be connected to the grounding grid of buried conductors and ground rods, as required for personnel safety. The substation ground grid will be tied to the plant ground grid.

Lightning protection will be provided by shield wires and/or lightning masts. The lightning protection system will be designed in accordance with IEEE 998 guidelines.

All faults will be detected, isolated, and cleared in a safe and coordinated manner as soon as practical to ensure the safety of equipment, personnel, and the public. Protective relaying will meet IEEE requirements and will be coordinated with the utility.

Each bus will be protected provided with redundant bus differential scheme. Each outgoing line will be provided with redundant high speed relay systems with transfer trip capability. Transmission lines will have microprocessor based distance relays with communication capability to the remote substation. Relay equipment for the remote ends are not included.

Each circuit breaker will be provided with independent breaker failure relay protection schemes.

Interface with the utility supervisory control and data acquisition (SCADA) system will be provided. Interface will be at the interface terminal box and RTU. Communication between the facility switchyard and the substation at the other end of the overhead transmission lines will be included. Remote Terminal Units (RTUs) will allow interface and remote control of the switchyards.

Revenue metering will be provided on the 115-kV and 69-kV outgoing recording net power to or from switchyards. Meters and the metering panel will be provided.

10D.3.2 Transformers

The generators will be connected to the 115-kV and 69-kV switchyards through main step-up transformers. The step-up transformers will be designed in accordance with ANSI standards C57.12.00, C57.12.90, and C57.91. The main transformers will be two-winding, delta-wye, OA/FA/FA. The neutral point of HV winding will be solidly grounded. Each main step-up transformer will have metal oxide surge arrestors adjacent to the HV terminals and will have manual de-energized ("no-load") tap changers located in HV windings.

The auxiliary power to the plant will be provided by two 13.8-kV to 4.16-kV station service transformers, one connected to the output of the steam turbine generator and the other connected to the output of one of the combustion turbine generators.

A separate 12-kV service from Turlock Irrigation District's (TID's) 12-kV distribution system will be provided for plant backup power. This service will be connected to the 4.16-kV switchgear via a 12.47-kV to 4.6-kV transformer.